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INITIAL BAB DATE 4/22/94

INEL

Idaho National Engineering Laboratory

Environmental Restoration

SEPTEMBER 1993

WINCO Environmental Restoration

ORIGINAL SIGNATURES INCLUDED

Track 1 Decision Documentation Package
Waste Area Group 3
Operable Unit 2

Site CPP-66
ICPP CFSGF Ash Pit

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA ·

Idaho National Engineering Laboratory

U.S. Department of Energy, Idaho Field Office

DECISION DOCUMENTATION PACKAGE
COVER SHEET

prepared in accordance with

**TRACK 1 SITES:
GUIDANCE FOR ASSESSING
LOW PROBABILITY HAZARD SITES
AT THE INEL**

Site Description: ICPP CFSGF ASH PIT

Site ID: CPP-66 **Operable Unit: 02**

Waste Area Group: 03 **Date: October 26, 1993**

I. SUMMARY - Physical description of the site:

CPP-66 is the site of an ash pit used for disposal of ash generated by the Coal-Fired Steam Generation Facility (CFSGF) at the Idaho Chemical Processing Plant (ICPP). The CFSGF complex is a 230 by 140m enclosure containing several buildings located southeast of the main ICPP security fence. The ash pit, in constant use since 1984, is immediately east of this complex and has dimensions of 190 by 120 by 3.5m.

Limestone is added to the coal prior to burning to reduce subsequent emissions of sulfur oxides and to control bed depth in a process called atmospheric fluidized bed combustion. The process residue (ash), consisting of fly ash, bottom ash, calcium carbonate and calcium sulfate, is mixed with water to produce a slurry before disposal in the ash pit.

The ash produced in this process contains measurable quantities of radionuclides and metals originally present in the coal and/or limestone. Waste pit ash has been analyzed for U-238, Th-232 and K-40, as well as for inorganic constituents. Concentrations of U-235 have been estimated from its normal concentration relative to U-238. Inorganics of potential concern include beryllium, boron, chromium, fluoride, molybdenum, silver, strontium, and tin.

The ash pit is currently in use and occupational exposures via fugitive dust inhalation, soil ingestion, and external exposure to radionuclides are properly addressed by operating procedures and safety plans governed by OSHA. However, to provide information to risk managers these pathways are evaluated in this document for both occupational and residential exposure scenarios.

DECISION RECOMMENDATION

II. SUMMARY - Qualitative Assessment of Risk:

The qualitative risk associated with this site is low. The majority of hazardous substances present in the ash occur at concentrations below INEL surface soil background concentrations, as characterized in Appendix F of the Track 1 guidance document (DOE/ID 1992). Only thorium-232 and chromium are present in the waste ash above known INEL background and both only slightly exceed background concentrations. Other constituents for which risk was assessed either had no INEL background concentration data against which they could be screened or had detection limits above INEL background. There are no other contaminants known to be associated with this process which have not been analyzed for in the waste ash.

The GWSCREEN 1.5 model was run to determine soil concentrations of concern associated with risk-based concentrations of potential contaminants in groundwater for a residential scenario. Even with conservative assumptions utilized in the modeling, estimated soil concentrations of concern are generally more than an order of magnitude greater than known concentrations in the waste ash. Due to the poor sorptive qualities of the substrata below the ash pit and the low concentrations of constituents in the source material, it is unlikely that higher concentrations have accumulated in the subsurface. The low permeability and leachability of dried ash, the likely installation of a cap during closure of the ash pit, and the low rainfall at the INEL suggest that the ash source will not be a threat to groundwater in the future.

The residential scenario risk assessment also evaluates potential human exposure via soil ingestion, fugitive dust inhalation, and external exposure to radionuclides. The risk-based concentration is exceeded for U-238 via the external exposure pathway. Beryllium via the soil ingestion pathway may also exceed the risk-based soil concentration, although the measured concentration in ash is within a standard deviation of zero. All other ash constituent concentrations are less than their respective risk-based concentrations. This scenario assumes a residence built directly upon the waste ash, i.e., the actual waste ash contaminant concentrations are compared directly to risk-based concentrations. Risk-based concentrations for radionuclides were not adjusted for radioactive decay.

The occupational exposure scenario evaluates potential human exposure via soil ingestion, inhalation of fugitive dust, and external exposure to radionuclides. No risk-based concentrations are exceeded for the occupational exposure scenario. This scenario also compares waste ash constituent concentrations directly with the risk-based concentrations. A second conservative assumption is the use of a particulate emission factor (PEF) based on highly erodible soils for estimating risk-based concentrations for fugitive dust inhalation. Because the ash slurry hardens to solid cake, it is unlikely to erode as rapidly as loose soil. Furthermore, soil is periodically placed over the ash when it is piled in a corner of the pit.

III. SUMMARY - Consequences of Error:

False Negative Error

If the site is determined incorrectly to pose no significant risk via the pathways evaluated, a potential for groundwater contamination and human exposure via the pathways described exists. A false negative error could exist if the values obtained for concentrations in the ash were erroneously low due to "hot spots" in the ash not being sampled. Also, if concentrations of inorganics or radionuclides in the coal or lime supplied to the facility increased since the last analysis (1989) it is likely that current concentrations in the ash would be higher as well. In this case, the site would present a proportionally greater risk than was estimated. The qualitative risk associated with this site is sufficiently low however, that even substantial underestimation of waste ash contaminant concentrations is unlikely to effect the overall evaluation.

False Positive Error

False positive error would be a source of concern if a course of action was initiated which was more costly in time or effort than would have been the case if the site risk was correctly interpreted. Contaminants which posed little risk at a site may become available during remediation efforts due to site disturbance, creating unnecessary exposure risks to workers, passers-by or nearby residents. At this site, the immediate result of a false positive error could include unnecessary soil and groundwater sampling. This would divert money from project work of importance and spend public funds needlessly.

IV. SUMMARY - Other Decision Drivers:

Several factors bear upon the qualitative risk associated with this site. Primarily, the future risk associated with human exposure at this site will be affected by the actions initiated during site closure and the type of future land use. The risk to groundwater will also be affected by closure procedures, specifically whether and how the site will be capped.

The residential exposure scenario utilizes a number of conservative assumptions for the ingestion, inhalation, and external exposure pathways. For example, to satisfy the assumptions inherent in the inhalation and external exposure risk assessment would require that a residence be constructed in an area the size of the current ash pit which has waste ash levels of contamination in soil to a depth of approximately 2 m.

The susceptibility to leaching of the radionuclides and inorganics present in the ash substrate is likely to be less than is usual for these constituents in soil. The buffering capacity of the ash medium will increase the pH of the leachate which reduces mobility of metals.

Data from a lab study characterizing leaching of inorganics from ash associated with atmospheric fluidized bed combustion units (Weber and Collings, 1987) found only barium and chromium to be present at concentrations of concern in leachate. Conditions at CPP-66 are such that still lesser concentrations might be expected due to the inclusion of spent bed materials in the site ash which increase ash volume without contributing significantly to metal concentrations.

The low precipitation at the INEL results in a relatively low driving force to groundwater for surface contaminants. This suggests that the liquid present in the ash slurry may provide a significant portion of the driving force to groundwater which will cease when the pit is closed. A cap will further reduce future driving forces to groundwater.

The geology of the ICPP area consists of alluvial deposits of the Big Lost River, ranging in depth from 6 to 15m overlying basalt. At a depth of approximately 31 to 33m a clayey area is present with thickness ranging from 0.15 to 3.4m. Groundwater depth is approximately 137m. The large depth to groundwater and the presence of an impermeable layer tend to reduce the groundwater risks associated with this site.

Recommended Action:

No further action is recommended for this site with regard to human exposure risks from identified site contaminants via the pathways evaluated in this document. The measured concentrations of radionuclides and inorganics in the waste ash are sufficiently low as to pose a negligible risk under both residential and occupational scenarios. The low permeability of the dried ash and low rainfall at the INEL provide little driving force for leaching of constituents in the ash and transportation of constituents to groundwater.

NO FURTHER ACTION DETERMINATION

The U.S. Department of Energy, the U.S. Environmental Protection Agency (EPA)-Region 10, and the State of Idaho have completed a review of the referenced information for CPP 66 hazardous waste site, as it pertains to the INEL Federal Facility Agreement of December 9, 1991. Based on this review, the Parties have determined that no further action for purposes of investigation or study is justified. This decision is subject to review at the time of issuance of the Record of Decision.

Brief summary of the basis for no further action:

Ash pile containing no contaminants at levels of concern

Revisit this decision at WAG wide to address solid waste regulatory issue.

References:

Track 1 pkg

DOE Project Manager Lisa Green for JLyle 4/13/93 Date

EPA Project Manager Wayne Pierre 12/2/93 Date

Idaho Project Manager Dean Nygard 4/13/93 Date

DECISION STATEMENT
(by DOE RPM)

Date Recd: 4/13/94 CPP-66

Disposition Site is currently operational fly ash pit. Present risks posed by site are not significant, however future risks should be considered in the WAG ~~wide~~ wide ROD, considering any other closure requirements that apply or would be applied in the future. No further action at this time.

DATE: 4/13/94	# PAGES (decision statement):
NAME: Lisa Green for J Lyle	SIGNATURE: Lisa Green for JLL

DECISION STATEMENT
(by EPA RPM)

Date Recd: 12/2/93 CPP 66

Disposition

Site of an ash pit used with the CFSGF cyclones + baghouse. Analysis of ash samples show contaminants below health-based concern, with the exception of U 238 & Beryllium which are both within one order of magnitude of the risk-based concentration. The site is currently operating. GW screen modeling do not show ash concentrations above levels of concern. No further action is necessary. However, the data developed should be revisited at the WAG-wide.

DATE: 12/2/93	**# PAGES (decision statement):** 23
NAME: Wayne Pierre	**SIGNATURE:** Wayne Pierre

DECISION STATEMENT
(by STATE RPM)

Date Recd: 4/13/94 CPP-66

Disposition

Site is a fly ash disposal area which has been in operation since 1984. Sampling of the area indicates there are some detectable concentrations of metals which are above natural background levels at INEL. Although GWSCREEN modeling does not indicate a risk at this time, it is important to note that the source will continue to increase. Additional data collection under the comprehensive RI may be ~~use~~ necessary to ensure newly generated waste does not pose a risk. Compliance with state solid waste requirements will also need to be addressed at the WAG wide comprehensive RI as an ARAR for those closed portions of the unit.

No further investigation appears required at this time, however, this ~~no~~ recommendation needs to be reviewed at the WAG wide scoping effort to ensure the available data is adequate.

DATE: 4/13/94 | # PAGES (decision statement):

NAME: Dean Nygard | SIGNATURE: Dean Nygard

PROCESS/WASTE WORKSHEET (sheet 1 of 8)
SITE ID: CPP-66

Col 1 Processes associated with this site	Col 2 Waste description & handling procedures	Col 3 Description & location of any artifacts/structures /disposal areas associated with this waste or process
Coal combustion in fluidized bed reactor (CFSGF).	Process residue is mixed with water to form a slurry and hauled to the ash disposal pit by truck.	Artifact: Ash disposal pit CPP-66 containing ash from the CFSGF. Location: Immediately southeast of the CFSGF at the ICPP across East Perimeter Road. Description: 190 by 120 by 3.5m pit. Ash is piled to depths of approximately 3m in the southwest corner of the pit. The eastern part of the pit receives water draining from the ash slurry. Part of the west side of the pit has been covered with earth as an interim cap.

PROCESS/WASTE WORKSHEET - Residential Scenario - Groundwater Ingestion (sheet 2 of 8)

Col 4 What Known/potential hazardous substance/constituents are associated with this waste or process?	Col 5 Potential Sources Associated with this hazardous material	Col 6 Concentration in ash[a,b,c,h]	Col 7 Risk Based Concentration in soil[d,h]	Col 8 Qualitative Risk Assessment (hi/med/low)	Col 9 Overall Reliability (hi/med/low)
Potassium-40	CFSGF Ash	2.8±0.18	f	low	high
Thorium-232	CFSGF Ash	1.5±0.26	60,000	low	high
Uranium-235	CFSGF Ash	0.075	3,200	low	high
Uranium-238	CFSGF Ash	1.6±0.15	1,800	low	high
Antimony	CFSGF Ash	<7.5/g	f	low	high
Arsenic	CFSGF Ash	2.0±1.2	f	low	high
Barium	CFSGF Ash	130±1.6	f	low	high
Beryllium	CFSGF Ash	1.1±1.8	7,000	low	high
Boron	CFSGF Ash	310±1.3	680	low	med
Cadmium	CFSGF Ash	0.59±1.9	f	low	high
Chromium[e]	CFSGF Ash	31±1.6	63	low	med
Cobalt	CFSGF Ash	<1.0/g	f	low	high
Copper	CFSGF Ash	20±1.8	f	low	high
Fluoride	CFSGF Ash	165±1.2	460	low	med
Lead	CFSGF Ash	15±1.3	f	low	high
Manganese	CFSGF Ash	39±1.3	f	low	high
Mercury	CFSGF Ash	0.037±2.4	f	low	high
Molybdenum	CFSGF Ash	2.1±1.3	38	low	high
Nickel	CFSGF Ash	8.2±1.5	f	low	high
Selenium	CFSGF Ash	1.6±1.7	f	low	high
Silver	CFSGF Ash	<1.5g	2,500	low	high
Strontium	CFSGF Ash	690±1.7	81,000	low	high
Tin	CFSGF Ash	<1.5g	4,600	low	high
Vanadium	CFSGF Ash	20±1.4	f	low	high
Zinc	CFSGF Ash	26±1.5	f	low	high

a measured concentration of radionuclides in waste ash, Hohorst (1990).
b measured concentration of inorganic constituents in waste ash, strong acid extract, Rope et al. (1987).
c inorganic data; geometric mean ± geometric standard deviation.
d estimated risk-based soil concentration using GWSCREEN 1.5.
e risk for chromium as chromium VI.
f risk-based calculations not performed for compounds present below INEL background concentrations.
g concentration at or below detection limit.
h radionuclides expressed as pCi/g, inorganics as mg/kg.

PROCESS/WASTE WORKSHEET - Residential Scenario - Soil Ingestion (sheet 3 of 8)

Col 4 What Known/potential hazardous substance/constituents are associated with this waste or process?	Col 5 Potential Sources Associated with this hazardous material	Col 6 Concentration in ash[a,b,c,h]	Col 7 Risk Based Concentration in soil[d,h]	Col 8 Qualitative Risk Assessment (hi/med/low)	Col 9 Overall Reliability (hi/med/low)
Potassium-40	CFSGF Ash	2.8±0.18	[f]	low	high
Thorium-232	CFSGF Ash	1.5±0.26	66	low	high
Uranium-235	CFSGF Ash	0.075	49	low	high
Uranium-238	CFSGF Ash	1.6±0.15	28	low	high
Antimony	CFSGF Ash	<7.5/[g]	[f]	low	high
Arsenic	CFSGF Ash	2.0±1.2	[f]	low	high
Barium	CFSGF Ash	130±1.6	[f]	low	high
Beryllium	CFSGF Ash	1.1±1.8	0.15	med	low
Boron	CFSGF Ash	310±1.3	24,000	low	high
Cadmium	CFSGF Ash	0.59±1.9	[f]	low	high
Chromium[e]	CFSGF Ash	31±1.6	1,400	low	high
Cobalt	CFSGF Ash	<1.0/[g]	[f]	low	high
Copper	CFSGF Ash	20±1.8	[f]	low	high
Fluoride	CFSGF Ash	165±1.2	16,000	low	high
Lead	CFSGF Ash	15±1.3	[f]	low	high
Manganese	CFSGF Ash	39±1.3	[f]	low	high
Mercury	CFSGF Ash	0.037±2.4	[f]	low	high
Molybdenum	CFSGF Ash	2.1±1.3	1,400	low	high
Nickel	CFSGF Ash	8.2±1.5	[f]	low	high
Selenium	CFSGF Ash	1.6±1.7	[f]	low	high
Silver	CFSGF Ash	<1.5[g]	1,400	low	high
Strontium	CFSGF Ash	690±1.7	162,000	low	high
Tin	CFSGF Ash	<1.5[g]	162,000	low	high
Vanadium	CFSGF Ash	20±1.4	[f]	low	high
Zinc	CFSGF Ash	26±1.5	[f]	low	high

a measured concentration of radionuclides in waste ash, Hohorst (1990).
b measured concentration of inorganic constituents in waste ash, strong acid extract, Rope et al. (1987).
c inorganic data; geometric mean ± geometric standard deviation.
d calculated risk-based soil concentration using Track 1 default parameters and equations, DOE/ID (1992).
e risk for chromium as chromium VI.
f risk-based calculations not performed for compounds present below INEL background concentrations.
g concentration at or below detection limit.
h radionuclides expressed as pCi/g, inorganics as mg/kg.

PROCESS/WASTE WORKSHEET - Residential Scenario - Inhalation of Fugitive Dust (sheet 4 of 8)

Col 4 What Known/potential hazardous substance/constituents are associated with this waste or process?	Col 5 Potential Sources Associated with this hazardous material	Col 6 Concentration in ash[a,b,c,h]	Col 7 Risk Based Concentration in soil[d,h]	Col 8 Qualitative Risk Assessment (hi/med/low)	Col 9 Overall Reliability (hi/med/low)
Potassium-40	CFSGF Ash	2.8±0.18	f	low	high
Thorium-232	CFSGF Ash	1.5±0.26	53	low	high
Uranium-235	CFSGF Ash	0.075	60	low	high
Uranium-238	CFSGF Ash	1.6±0.15	29	low	high
Antimony	CFSGF Ash	<7.5/g	f	low	high
Arsenic	CFSGF Ash	2.0±1.2	f	low	high
Barium	CFSGF Ash	130±1.6	f	low	high
Beryllium	CFSGF Ash	1.1±1.8	310	low	high
Boron	CFSGF Ash	310±1.3	i	low	med
Cadmium	CFSGF Ash	0.59±1.9	f	low	high
Chromium[e]	CFSGF Ash	31±1.6	63	low	med
Cobalt	CFSGF Ash	<1.0/g	f	low	high
Copper	CFSGF Ash	20±1.8	f	low	high
Fluoride	CFSGF Ash	165±1.2	i	low	med
Lead	CFSGF Ash	15±1.3	f	low	high
Manganese	CFSGF Ash	39±1.3	f	low	high
Mercury	CFSGF Ash	0.037±2.4	f	low	high
Molybdenum	CFSGF Ash	2.1±1.3	i	low	med
Nickel	CFSGF Ash	8.2±1.5	f	low	high
Selenium	CFSGF Ash	1.6±1.7	f	low	high
Silver	CFSGF Ash	<1.5g	i	low	med
Strontium	CFSGF Ash	690±1.7	i	low	med
Tin	CFSGF Ash	<1.5g	i	low	med
Vanadium	CFSGF Ash	20±1.4	f	low	high
Zinc	CFSGF Ash	26±1.5	f	low	high

a measured concentration of radionuclides in waste ash, Hohorst (1990).
b measured concentration of inorganic constituents in waste ash, strong acid extract, Rope et al. (1987).
c inorganic data; geometric mean ± geometric standard deviation.
d calculated risk-based soil concentration using Track 1 default parameters and equations, DOE/ID (1992).
e risk for chromium as chromium VI.
f risk-based calculations not performed for compounds present below INEL background concentrations.
g concentration at or below detection limit.
h radionuclides expressed as pCi/g, inorganics as mg/kg.
i no EPA inhalation toxicity values available for these contaminants.

PROCESS/WASTE WORKSHEET - Residential Scenario - External Exposure to Radionuclides (sheet 5 of 8)

Col 4 What Known/potential hazardous substance/constituents are associated with this waste or process?	Col 5 Potential Sources Associated with this hazardous material	Col 6 Concentration in ash[a,b]	Col 7 Risk Based Concentration in soil[c]	Col 8 Qualitative Risk Assessment (hi/med/low)	Col 9 Overall Reliability (hi/med/low)
Potassium-40	CFSGF Ash	2.8±0.18	d	low	high
Thorium-232	CFSGF Ash	1.5±0.26	1,300	low	high
Uranium-235	CFSGF Ash	0.075	0.15	low	med
Uranium-238	CFSGF Ash	1.6±0.15	0.97	med	med

a measured concentration of radionuclides in waste ash, Hohorst (1990).
b radionuclides expressed as pCi/g, inorganics as mg/kg.
c calculated risk-based soil concentration using Track 1 default parameters and equations, DOE/ID (1992).
d risk-based calculations not performed for compounds present below INEL background concentrations

PROCESS/WASTE WORKSHEET - Occupational Scenario - Soil Ingestion (sheet 6 of 8)

Col 4 What Known/potential hazardous substance/constituents are associated with this waste or process?	Col 5 Potential Sources Associated with this hazardous material	Col 6 Concentration in ash[a,b,c,h]	Col 7 Risk Based Concentration in soil[d,h]	Col 8 Qualitative Risk Assessment (hi/med/low)	Col 9 Overall Reliability (hi/med/low)
Potassium-40	CFSGF Ash	2.8±0.18	f	low	high
Thorium-232	CFSGF Ash	1.5±0.26	270	low	high
Uranium-235	CFSGF Ash	0.075	200	low	high
Uranium-238	CFSGF Ash	1.6±0.15	110	low	high
Antimony	CFSGF Ash	<7.5/g	f	low	high
Arsenic	CFSGF Ash	2.0±1.2	f	low	high
Barium	CFSGF Ash	130±1.6	f	low	high
Beryllium	CFSGF Ash	1.1±1.8	1.3	med	low
Boron	CFSGF Ash	310±1.3	180,000	low	high
Cadmium	CFSGF Ash	0.59±1.9	f	low	high
Chromium[e]	CFSGF Ash	31±1.6	10,000	low	high
Cobalt	CFSGF Ash	<1.0/g	f	low	high
Copper	CFSGF Ash	20±1.8	f	low	high
Fluoride	CFSGF Ash	165±1.2	120,000	low	high
Lead	CFSGF Ash	15±1.3	f	low	high
Manganese	CFSGF Ash	39±1.3	f	low	high
Mercury	CFSGF Ash	0.037±2.4	f	low	high
Molybdenum	CFSGF Ash	2.1±1.3	10,000	low	high
Nickel	CFSGF Ash	8.2±1.5	f	low	high
Selenium	CFSGF Ash	1.6±1.7	f	low	high
Silver	CFSGF Ash	<1.5g	10,000	low	high
Strontium	CFSGF Ash	690±1.7	1,200,000	low	high
Tin	CFSGF Ash	<1.5g	1,200,000	low	high
Vanadium	CFSGF Ash	20±1.4	f	low	high
Zinc	CFSGF Ash	26±1.5	f	low	high

a measured concentration of radionuclides in waste ash, Hohorst (1990).
b measured concentration of inorganic constituents in waste ash, strong acid extract, Rope et al. (1987).
c inorganic data; geometric mean ± geometric standard deviation.
d calculated risk-based soil concentration using Track 1 default parameters and equations, DOE/ID (1992).
e risk for chromium as chromium VI.
f risk-based calculations not performed for compounds present below INEL background concentrations.
g concentration at or below detection limit.
h radionuclides expressed as pCi/g, inorganics as mg/kg.

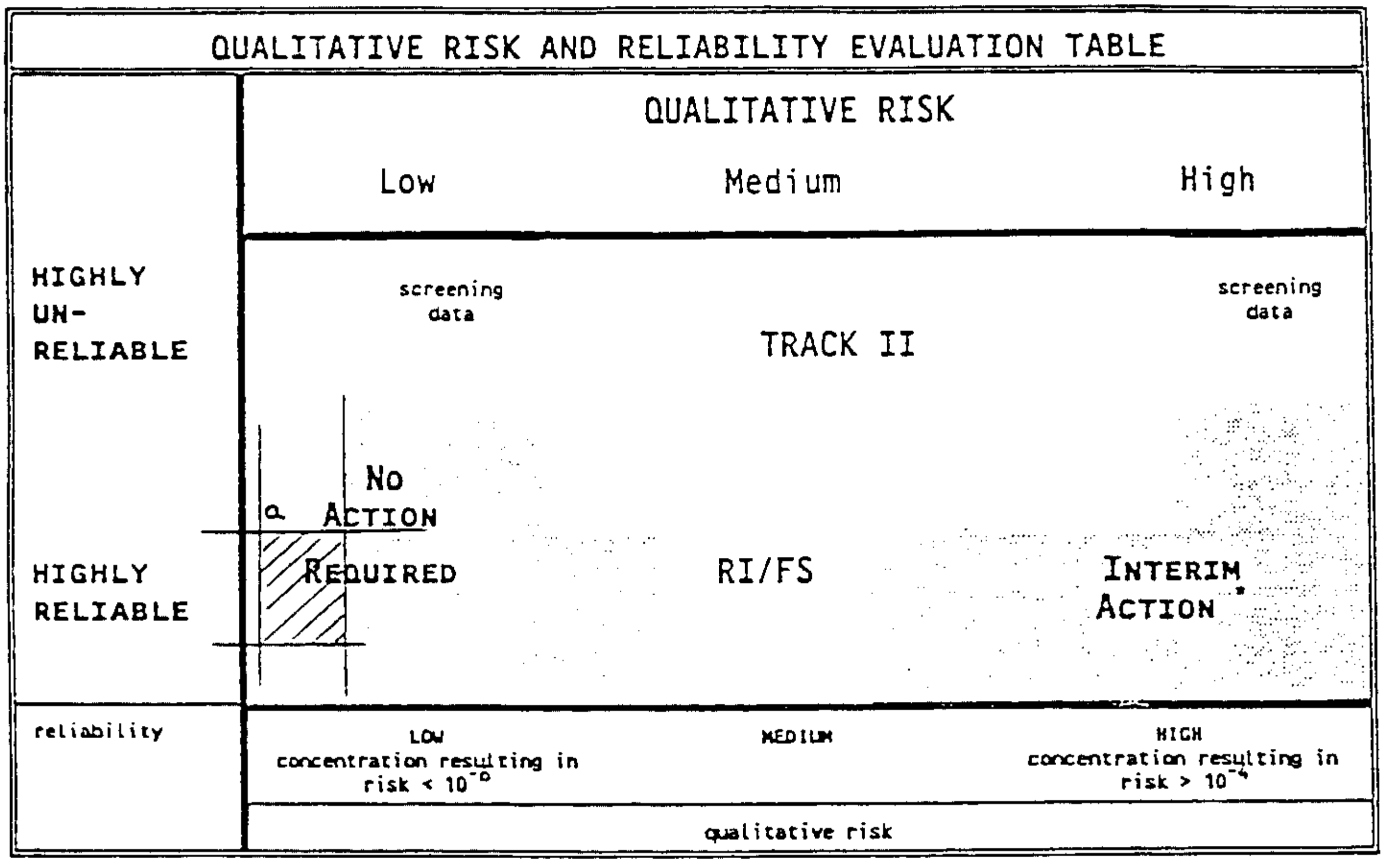
PROCESS/WASTE WORKSHEET - Occupational Scenario - Inhalation of Fugitive Dust (sheet 7 of 8)					
Col 4 What Known/potential hazardous substance/constituents are associated with this waste or process?	Col 5 Potential Sources Associated with this hazardous material	Col 6 Concentration in ash[a,b,c,h]	Col 7 Risk Based Concentration in soil[d,h]	Col 8 Qualitative Risk Assessment (hi/med/low)	Col 9 Overall Reliability (hi/med/low)
Potassium-40	CFSGF Ash	2.8±0.18	[f]	low	high
Thorium-232	CFSGF Ash	1.5±0.26	89	low	high
Uranium-235	CFSGF Ash	0.075	99	low	high
Uranium-238	CFSGF Ash	1.6±0.15	48	low	high
Antimony	CFSGF Ash	<7.5/[g]	[f]	low	high
Arsenic	CFSGF Ash	2.0±1.2	[f]	low	high
Barium	CFSGF Ash	130±1.6	[f]	low	high
Beryllium	CFSGF Ash	1.1±1.8	520	low	high
Boron	CFSGF Ash	310±1.3	[i]	low	med
Cadmium	CFSGF Ash	0.59±1.9	[f]	low	high
Chromium[e]	CFSGF Ash	31±1.6	100	low	med
Cobalt	CFSGF Ash	<1.0/[g]	[f]	low	high
Copper	CFSGF Ash	20±1.8	[f]	low	high
Fluoride	CFSGF Ash	165±1.2	[i]	low	med
Lead	CFSGF Ash	15±1.3	[f]	low	high
Manganese	CFSGF Ash	39±1.3	[f]	low	high
Mercury	CFSGF Ash	0.037±2.4	[f]	low	high
Molybdenum	CFSGF Ash	2.1±1.3	[i]	low	med
Nickel	CFSGF Ash	8.2±1.5	[f]	low	high
Selenium	CFSGF Ash	1.6±1.7	[f]	low	high
Silver	CFSGF Ash	<1.5[g]	[i]	low	med
Strontium	CFSGF Ash	690±1.7	[i]	low	med
Tin	CFSGF Ash	<1.5[g]	[i]	low	med
Vanadium	CFSGF Ash	20±1.4	[f]	low	high
Zinc	CFSGF Ash	26±1.5	[f]	low	high

a measured concentration of radionuclides in waste ash, Hohorst (1990).
b measured concentration of inorganic constituents in waste ash, strong acid extract, Rope et al. (1987).
c inorganic data; geometric mean ± geometric standard deviation.
d calculated risk-based soil concentration using Track 1 default parameters and equations, DOE/ID (1992).
e risk for chromium as chromium VI.
f risk-based calculations not performed for compounds present below INEL background concentrations.
g concentration at or below detection limit.
h radionuclides expressed as pCi/g, inorganics as mg/kg.
i no EPA inhalation toxicity values available for these contaminants.

PROCESS/WASTE WORKSHEET - Occupational Scenario - External Exposure to Radionuclides (sheet 8 of 8)

Col 4 What Known/potential hazardous substance/constituents are associated with this waste or process?	Col 5 Potential Sources Associated with this hazardous material	Col 6 Concentration in ash[a][b]	Col 7 Risk Based Concentration in soil[c]	Col 8 Qualitative Risk Assessment (hi/med/low)	Col 9 Overall Reliability (hi/med/low)
Potassium-40	CFSGF Ash	2.8±0.18	d	low	high
Thorium-232	CFSGF Ash	1.5±0.26	6,900	low	high
Uranium-235	CFSGF Ash	0.075	0.75	low	high
Uranium-238	CFSGF Ash	1.6±0.15	5.0	low	med

a measured concentration of radionuclides in waste ash, Hohorst (1990).
b radionuclides expressed as pCi/g, inorganics as mg/kg.
c calculated risk-based soil concentration using Track 1 default parameters and equations, DOE/ID (1992).
d risk-based calculations not performed for compounds present below INEL background concentrations



* If sufficient data exist to identify an appropriate remedy.

Question 1. What are the waste generation process locations and dates of operation associated with this site?

Block 1 Answer:

The Coal-Fired Steam Generation Facility (CFSGF) produces steam for the ICPP and is the source for the ash disposed of at the CPP-66 disposal pit. The CFSGF consists of two atmospheric fluidized bed combustion units constructed in 1982-1983 and put into use in 1984. The facility has been in use continuously since construction. Each unit is capable of generating steam at 30,600 kg/hr. Particulate stack emissions (fly ash) are controlled by cyclones and a baghouse. Fly ash and spent bed material consisting of bottom ash, calcium sulfate, and calcium carbonate are mixed with water to form a slurry in order to minimize particle entertainment during transport via truck and dumping in the ash disposal pit.

The CFSGF is located in the southeast portion of the ICPP which is itself in the southern part of the INEL along the Big Lost River. The CFSGF facility is a 230 by 140m enclosure, southeast of the main ICPP security fence, which contains several buildings. The combustion building is designated CPP-687.

Block 2 How reliable are the information sources? x High __Med __Low (check one)
Explain the reasoning behind this evaluation.

The information is primarily taken from the four letters authored by F.A. Hohorst and Rope, et al., 1987.

Block 3 Has this INFORMATION been confirmed? x Yes __No (check one)
If so, describe the confirmation.

Corroborating information was obtained from INEL, 1992. Information concerning the process at the CFSGF, dates and locations, is consistent among the referenced documents.

Block 4 **Sources of Information** [check appropriate box(es) & source number from reference list]

No available information	[ ]		Analytical data	[ ]	
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[x]	1, 2, 3, 4, 6	Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Aerial photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[x]	9, 10	D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
OTHER	[ ]				

Question 2. What are the disposal process locations and dates of operation associated with this site? How was the waste disposed?

Block 1 Answer:

The CPP-66 ash disposal pit is the disposal site for process ash generated at the CFSGF. The ash pit has been in constant use since 1984 when the CFSGF began operation. Contaminants associated with process ash of this nature include naturally occurring radionuclides and metals. Ash arrives in the form of a wet slurry in trucks from the CFSGF. The ash is dumped in the pit and allowed to dry, excess liquid may drain to the eastern portion of the pit. Periodically, the ash is pushed into piles approximately 3m in depth in the southwest corner of the pit. A portion of the western area of the pit has been covered with an interim soil cover.

The CPP-66 ash pit is located immediately southeast of the CFSGF along East Perimeter Road in the ICPP. The pit dimensions are 190 by 120 by 3.5m or approximately 2.3 ha. The site coordinates of the ash pit are N693292/E298210.

Block 2 How reliable are the information sources? x High __Med __Low (check one)
Explain the reasoning behind this evaluation.

Information was obtained from the four letters authored by F.A. Hohorst and the document authored by Rope, et al. Additional information was obtained from INEL, 1992.

Block 3 Has this INFORMATION been confirmed? x Yes __No (check one)
If so, describe the confirmation.

The information obtained from the listed sources concerning disposal processes, dates, and locations is consistent among the various documents cited.

Block 4 **Sources of Information** [check appropriate box(es) & source number from reference list]

No available information	[ ]		Analytical data	[ ]	
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[x]	1, 2, 3, 4, 6	Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Aerial photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[x]	9, 10	D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
OTHER	[ ]				

Question 3. Is there evidence that a source exists at this site? If so, list the sources and describe the evidence.

Block 1 Answer: Yes

Waste ash associated with atmospheric fluidized bed combustion is known to contain measurable quantities of radionuclides and inorganics which occur naturally in the coal and/or limestone utilized in the process. Sampling of the waste ash from the CFSGF in 1984 confirmed the presence of detectable quantities of metals, some of which are above the natural background concentrations in surface soils at the INEL. Sampling of the waste ash for radionuclides was performed four times in the period from 1986 to 1990. These samples consistently showed measurable quantities of radionuclides, some of which are above INEL surface soil background concentrations. Of the compounds detected only two, thorium-232 and chromium, were measured at concentrations above a known background. Additional compounds detected for which no INEL background data was available or whose compound detection limit was above the INEL background concentration include uranium-235/238, beryllium, boron, fluoride, molybdenum, silver, strontium, and tin.

In addition to the waste ash in the pit, the soils below the disposal pit may have been contaminated by radionuclides and metals leaching from the ash. These soils could now present a source of contamination to groundwater independent of the ash in the disposal pit. The likelihood that subsurface soils are a significant source is negligible however due to the low initial concentrations in the ash.

Block 2 How reliable are the information sources? __High _X_Med __Low (check one)
Explain the reasoning behind this evaluation.

Waste ash is an inherently heterogenous media with respect to concentrations of metals and radionuclides as evidenced by the high variability associated with the site sampling data and according to referenced literature. Additionally, radionuclide and inorganic concentrations vary in coal and limestone depending upon source. If the sources varied after 1989, current concentrations could vary from 1989 sampling data concentrations. Finally, current ash volume has been estimated based upon 1989 volume and growth in volume projected from ash accumulated in the period between October 1, 1988 to December 31, 1989.

Block 3 Has this INFORMATION been confirmed? _x_Yes __No (check one)
If so, describe the confirmation.

Analytical data for radionuclides was obtained from the letter authored by F.A. Hohorst dated January 8, 1990. Inorganics data was obtained from Table 3 of Rope, et al. 1987. Independent confirmation was not available. Concentrations of inorganics were reported to have been determined using appropriate calibration standards during analysis.

Block 4 **Sources of Information** [check appropriate box(es) & source number from reference list]

No available information	[ ]		Analytical data	[x]	1, 6
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[ ]		Disposal data	[x]	1, 2, 3, 4, 5
Current process data	[ ]		Q.A. data	[ ]	
Aerial photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[ ]		D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
OTHER	[ ]				

Question 4. Is there empirical, circumstantial, or other evidence of migration? If so, what is it?

Block 1 Answer: Yes

There is no direct soil sampling data or groundwater monitoring data to confirm migration of either radionuclides or inorganics from the CPP-66 ash disposal pit. However, liquid from the ash slurry is known to have collected in the eastern portion of the pit and the ash is known to have been exposed to rain for some period of time. An interim soil cover on the western portion of the pit was installed in 1987 or early 1988 and may have reduced further leaching in this area due to rainwater infiltration. It is reasonable to assume that some contaminants in the ash may have migrated vertically into the ground.

Vertical migration is expected to be minimal at this site, however, for several reasons. Waste ash associated with fluidized bed combustion is known to have low leachability from data presented by Weber and Collings, 1987. This is in accord with predicted low mobility of inorganics in a basic media such as ash. Ash of this nature has a cementitious quality. Once dried, it forms a hard mass which is resistant to further leaching. The low rainfall at the INEL also diminishes the possibility of leaching. Finally, the low solubility of constituents will encourage partitioning from leachate onto soils. Thus, any zone of contamination beneath the ash pit is likely to be confined to soil near the surface.

There is no evidence that contamination has migrated via fugitive dust. The solid nature of the dried ash slurry, and the practice of periodically covering the dried slurry with soil as it accumulates, diminishes the possibility of migration by this mechanism.

Block 2 How reliable are the information sources? __High X Med __Low (check one)

Explain the reasoning behind this evaluation.

Although no direct soil or groundwater samples exist, the contaminant concentrations in the waste ash are well characterized as is the hydrogeology at the ICPP site. Sufficient information exists to model expected soil concentrations beneath the ash pit associated with risk-based contaminant concentrations in groundwater. The likelihood of exceeding this concentration and the probability of migration can be qualitatively discussed with confidence based upon this information.

Block 3 Has this INFORMATION been confirmed? __Yes X No (check one)

If so, describe the confirmation.

Contaminant concentrations in the waste ash have been confirmed by analysis. Analysis of soil samples from below the ash pit has not been performed. Migration of contaminants can only be inferred, not conclusively demonstrated, from available information.

Block 4 **Sources of Information** [check appropriate box(es) & source number from reference list]

No available information	[ ]		Analytical data	[ ]	
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[ ]		Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Aerial photographs	[x]	1, 2, 3, 4, 5	Safety analysis report	[ ]	
Engineering/site drawings	[x]	9, 10	D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
OTHER	[ ]				

Question 5. Does site operating or disposal historical information allow estimation of the pattern of potential contamination? If the pattern is expected to be a scattering of hot spots, what is the expected minimum size of a significant hot spot?

Block 1 Answer: Yes

Some contamination is potentially present beneath the entire ash pit. Photographic evidence depicts an area in the eastern portion of the pit where liquid from the ash slurry accumulates. Higher concentrations of contaminants might exist in the soil below this area due to higher infiltration rates of leachate at this point. The dimensions of this area are uncertain and could be expected to fluctuate with the periodic dumping of ash slurry. A site survey to assess the contours of the pit would be necessary to more accurately describe the areal extent of the expected hot spot.

Block 2 How reliable are the information sources? __High __Med X Low (check one)

Explain the reasoning behind this evaluation.

The soil beneath the ash pit, if it corresponds to ICPP surface soil characteristics, consists of gravel, course sand, and cobbles. Such material would likely have a high hydraulic conductivity. Thus it is possible that although liquid accumulates in the eastern portion of the pit, an equal or greater volume of liquid may percolate into the ground directly below the dumped ash. Evidence suggests the western part of the pit was filled first with the more eastern areas currently receiving new ash slurry. However, it is not certain which areas have received the greatest volumes of wet ash.

Block 3 Has this INFORMATION been confirmed? x Yes __No (check one)

If so, describe the confirmation.

Photographic evidence exists that liquid may occasionally pool in the eastern portion of the pit.

Block 4 **Sources of Information** [check appropriate box(es) & source number from reference list]

No available information	[ ]		Analytical data	[ ]	
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[x]	1, 2, 3, 4, 5	Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Aerial photographs	[x]	1, 2, 3, 4, 5	Safety analysis report	[ ]	
Engineering/site drawings	[ ]		D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
OTHER	[ ]				

Question 6. Estimate the length, width, and depth of the contaminated region. What is the known or estimated volume of the source? If this is an estimated volume, explain carefully how the estimate was derived.

Block 1 Answer:

The ash pit has dimensions of approximately 190 by 120 by 3.5m. The current volume of the ash is estimated at approximately 61,500m^3, based upon volume in 1989 and addition of ash in the period of October 1, 1988 to December 31, 1989. The average depth of the ash is estimated to be 2.7m. Although it is known that depths are currently greater in the western portion of the pit, the exact variability with area is uncertain. The greater depths are also associated with dry ash rather than ash slurry. For modeling purposes, an equal thickness of 2.7m is assumed. The dimensions of a contaminated soil source, if it exists, are unknown. The areal extent of such a source would likely not be much greater than the area of the ash pit. The vertical profile would depend upon concentration and sorption of contaminants from the leachate onto soils, permeability and porosity of the underlying materials, the volume of liquid discharged from the ash, and the fraction of liquid evaporated.

Block 2 How reliable are the information sources? __High x_Med __Low (check one)

Explain the reasoning behind this evaluation.

The information which is known concerning the dimensions of the ash pit and the volume in 1989 is known with high certainty from the report by F.A. Hohorst, 1990. Extrapolation to current conditions require assumptions of continuity in the CFSGF process.

Block 3 Has this INFORMATION been confirmed? __Yes x_No (check one)

If so, describe the confirmation.

Information concerning ash pit dimensions and ash volume are reported in Hohorst, 1990. However, estimates of the thickness of the ash source and information regarding the presence of a contaminated soil source have not been confirmed.

Block 4 **Sources of Information** [check appropriate box(es) & source number from reference list]

No available information	[ ]		Analytical data	[ ]	
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[x]	1	Disposal data	[x]	1
Current process data	[ ]		Q.A. data	[ ]	
Aerial photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[ ]		D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
OTHER	[ ]				

Question 7.	What is the known or estimated quantity of hazardous substance/constituent at this source? If the quantity is an estimate, explain carefully how the estimate was derived.

Block 1 Answer:

Quantities of contaminants in the ash pit are determined from the estimated current volume (61,500m^3) and density (710 kg/m^3) of ash contained in the pit multiplied by measured concentrations as reported in Hohorst, 1990 and Rope, et al., 1987. Contaminant concentrations in the soils below the ash pit are unknown.

Constituent	Concentration in ash[a]	Estimated Quantity[b]
Potassium-40	2.8	0.12
Thorium-232	1.5	0.065
Uranium-235	0.075	0.0033
Uranium-238	1.6	0.070
Antimony	<7.5	<330
Arsenic	2.0	87
Barium	130	5700
Beryllium	1.1	48
Boron	310	14,000
Cadmium	0.59	26
Chromium	31	1400
Cobalt	<1.0	<44
Copper	20	870
Fluoride	165	7200
Lead	15	650
Manganese	39	1700
Mercury	0.037	1.6
Molybdenum	2.1	92
Nickel	8.2	360
Selenium	1.6	70
Silver	<1.5	<65
Strontium	690	30,000
Tin	<1.5	<65
Vanadium	20	870
Zinc	26	1100

[a]radionuclides expressed as pCi/g, inorganics as mg/kg
[b]radionuclides expressed as Ci, inorganics as metric tons (1 metric ton = 1000 kg)

Block 2 How reliable are the information sources? __High x Med __Low (check one)

Explain the reasoning behind this evaluation.

The current quantities of these constituents have been estimated based upon two assumptions:

1. the concentrations of inorganics in the waste ash as sampled in 1984 and the concentrations of radionuclides in the waste ash as sampled in 1989 have remained constant to the present time, and
2. the rate of increase in ash volume from October 1, 1988 to December 31, 1989 is representative of increases in ash volume from January 1, 1990 to the present time.

Block 3 Has this INFORMATION been confirmed? __Yes x No (check one)

If so, describe the confirmation.

These current quantities are projected from past concentrations and have not been confirmed by recent process information or sampling.

Block 4 **Sources of Information** [check appropriate box(es) & source number from reference list]

No available information	[ ]		Analytical data	[x]	1, 6
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[ ]		Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Aerial photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[ ]		D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
OTHER	[ ]				

Question 8. Is there evidence that this hazardous substance/constituent is present at the source as it exists today? If so, describe the evidence.

Block 1 Answer: Yes

The natures of the hazardous substances identified at CPP-66 indicate that it is highly likely that they are still present at the site today. The radiological parameters identified in 1989 are all primordial radionuclides having very long half-lives, they will not significantly decay with time. The pH of the ash media is likely to be neutral or basic minimizing the mobility of the constituents.

Block 2 How reliable are the information sources? x High __Med __Low (check one)

Explain the reasoning behind this evaluation.

Ash sampling data confirms the presence of radionuclides and inorganics in the waste ash. No mechanisms exist which could reasonably be expected to cause significant loss of these constituents from the source area in the time elapsed since sampling.

Block 3 Has this INFORMATION been confirmed? x Yes __No (check one)

If so, describe the confirmation.

Historical data provides evidence of radiological and inorganic constituents in the waste ash. Radiological constituents have been identified in four separate sampling events from 1986 to 1989.

Block 4 **Sources of Information** [check appropriate box(es) & source number from reference list]

No available information	[ ]		Analytical data	[x]	1, 2, 3, 4, 5, 6
Anecdotal	[ ]		Documentation about data	[ ]	
Historical process data	[x]	1, 2, 3, 4, 5	Disposal data	[ ]	
Current process data	[ ]		Q.A. data	[ ]	
Aerial photographs	[ ]		Safety analysis report	[ ]	
Engineering/site drawings	[ ]		D&D report	[ ]	
Unusual Occurrence Report	[ ]		Initial assessment	[ ]	
Summary documents	[ ]		Well data	[ ]	
Facility SOPs	[ ]		Construction data	[ ]	
OTHER	[ ]				

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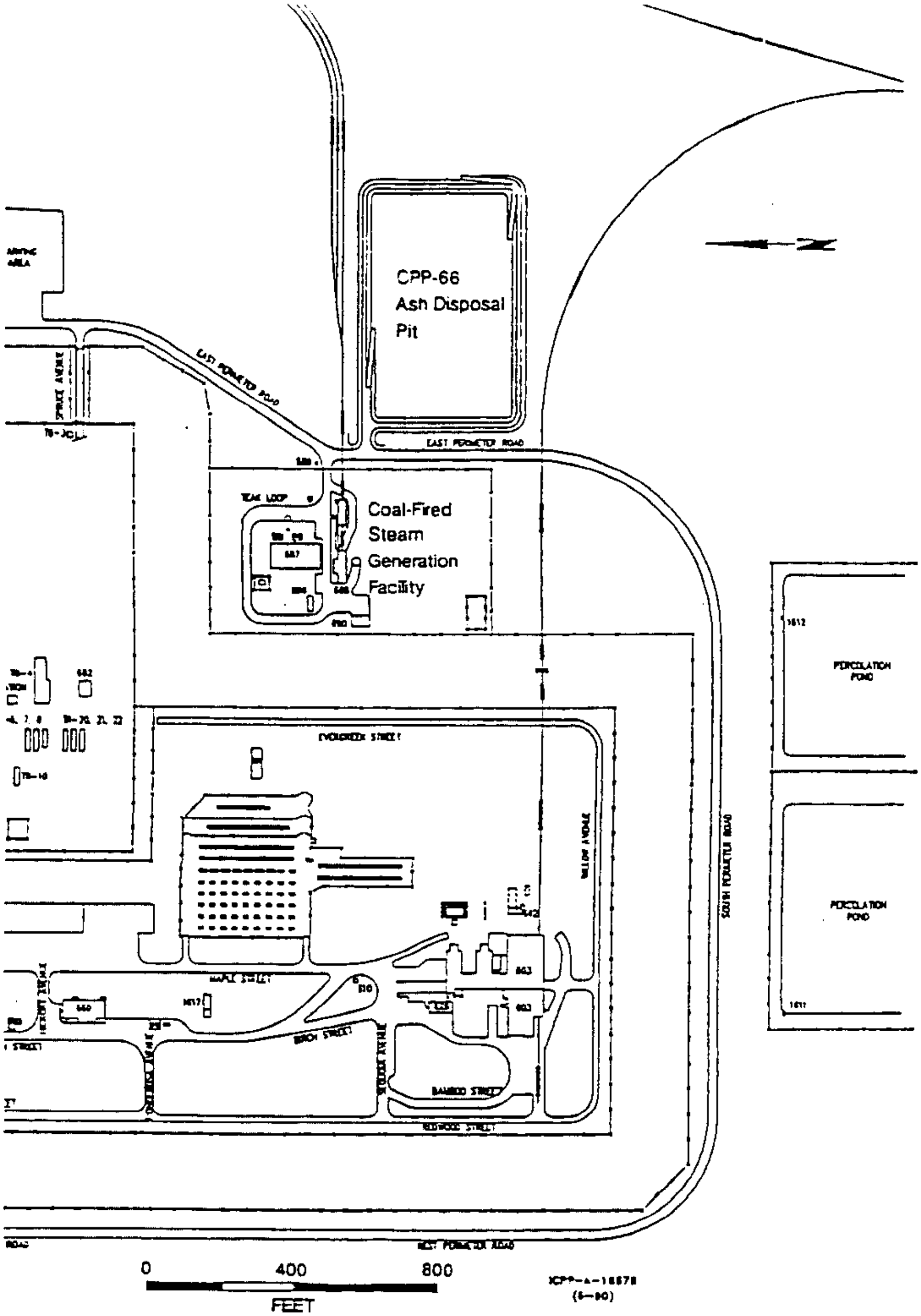

FIGURE 1. SITE PLAN OF THE ICPP, SOUTH END